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Fronczek-Munter, Aneta

Published in:
Proceedings

Publication date:
2011

Document Version
Publisher's PDF, also known as Version of record

[Link back to DTU Orbit](#)

Citation (APA):
Fronczek-Munter, A. (2011). Usability and user driven innovation - unity or clash? In *Proceedings*

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USABILITY AND USER DRIVEN INNOVATION – UNITY OR CLASH?

Author:

PhD student, Architect M.Sc. Arch. Eng. *Aneta Fronczek-Munter*
Technical University of Denmark, Department of Management Engineering,
Planning and Management of the Built Environment

CV

The author is an Architect Engineer, M.Sc. with 6 years of experience in the architecture and planning industry, mainly in Denmark, Poland and Germany. She was involved in several projects of various scale in commercial architecture, including both master planning and interior design. She is currently working with research in Usability, Briefing, Facilities Management and User involvement in Hospital buildings as a PhD student at Technical University of Denmark.

ABSTRACT

Aim: To present different understandings of the concepts ‘usability’ and ‘user driven innovation’ and discuss if and how the built environment can benefit from these concepts and the unity of them.

Approach and methodology: The paper is based on literature reviews of scientific journals and other influential publications within the academic fields of Facilities Management, Architecture and Engineering, Participatory Design and Software design.

Outline: The paper will discuss different understandings of the concept ‘usability’ and its relation to ‘user driven innovation’, which depends on the academic field and area of professional application. The concept of usability has its roots in evaluations of consumer products and user interfaces of computer software. During the last 5-10 years there has been a new development of research in usability of buildings and workplaces. Recently researchers have identified additional key concepts to usability: Context, culture, situation and experience. Understanding those might be achieved by involving users. In this paper, usability of the built environment will be related to the idea of ‘user driven innovation’ - participatory processes in which users are involved in design. The question in this paper is *to what extent*, and *how* users can be involved in design processes to create better and innovative buildings of enhanced usability.

Keywords: usability, user driven innovation, built environment, facilities management, participatory design

INTRODUCTION / OBJECTIVE

There seems to be a lack of common understanding of the concepts ‘usability’ and ‘user driven innovation’ across different professional fields. This paper aims at presenting the different understandings of the concepts ‘usability’ and ‘user driven innovation’ and discussing if and how the built environment can benefit from these concepts and the unity of them.

The concept of usability has its roots in evaluations of consumer products and user interfaces of computer software. During the last 5-10 years there has been a new development of research in usability of buildings and workplaces. Recently researchers have identified additional key concepts to usability: Context, culture, situation and experience. Understanding those might be achieved by involving users. In this paper, usability of the built environment will be related to the idea of ‘user driven innovation’ - participatory processes in which users are involved in design. The question in this paper is *to what extent*, and *how* users can be involved in design processes to create better and innovative buildings of enhanced usability.

The claim is that the two concepts supplement each other and user driven innovation can be used as one of the methods to improve the usability of the built environment. The field might benefit from a deeper understanding of the concepts and learn from experiences from other fields.

Those who benefit from this paper can include Facility Managers and building clients in general, as well as actors involved in planning the facilities, like architects, engineers and designers.

DESIGN / METHODOLOGY / APPROACH

The paper is based on literature reviews of scientific journals and other influential publications on subjects *Usability* and *User driven innovation* within the academic fields of Facilities Management, Architecture and Engineering, Participatory Design and Software design.

The paper analyses the literature and discusses the different understandings of the concepts *Usability* and *User driven innovation*, depending on the specific field. The result of the analysis and one of the goals is broadening the awareness of possible positive impacts of combining the understandings and experiences with *Usability* and *User driven innovation* from several professional fields. The paper shows the advantages of the *Usability* and *User Driven Innovation* concepts to the field of Built Environment, where they have not been used widely yet. The implications for practice are therefore mostly gaining more understanding of positive values of using the concepts of *Usability* and *User Driven Innovation* in this context. Such a deeper understanding of the concepts can be gained by combining existing knowledge from different professional fields in new ways.

It needs to be mentioned that the author has own experiences as an architect in planning built environments. Those experiences undoubtedly influence the focus and approach of the research and this article. Furthermore she is involved in case studies in healthcare sector, and the initial stages of planning healthcare facilities, where the concepts of *Usability* and *User driven innovation* are tested with the plan of future additional publications of the results.

RESULTS OF LITERATURE REVIEW

CONCEPT OF 'USABILITY'

The concept of *Usability* is defined in ISO 9241-11 as: "The extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use" (ISO, 1998).

The concept of *Usability* has its roots in evaluations of consumer products and user interfaces of computer software. It is though widely understood nowadays as *Usability Tests*, which is a method, where the already developed product prototype is being tested in a Usability Lab with a group of potential users to see if it is acceptable and useful for the target group members. That process will often lead to development of additional improvements and making a second prototype. Traditionally the manufacturing companies are themselves developing the prototypes, innovating and making patents in their R&D (Research and Development) departments and only invite the users for the Usability Testing. As von Hippel describes it, "senior designers at firms have long been supplied by engineers and designers under their direct control, and with the resources to (...) construct and test prototype designs" (von Hippel, 2005). According to von Hippel it is still the vast majority of manufacturers that think that product and service development are always done by them, and that it is their task to find a need and fill it, rather than finding an innovation that lead users have already developed and commercialising it. Even though the innovation by manufacturers and usability testing was and still is widespread in many fields, it has been shown that "the traditional pattern of concentrating innovation-support resources on a few individuals is hugely inefficient" because it is hard to determine the right people who might develop a valuable innovation. (von Hippel, 2005).

There has been a shift in the recent years described by von Hippel as "Democratizing innovation", where more companies turn to *User Innovation*, also called *user centered innovation* or *user driven innovation*, when they introduce new Products or Computer Software. The concept of *User driven innovation* is described further in the next chapter.

In the field of Architecture the *Usability* concept is in principle well known for centuries. It was already mentioned in writing in Ancient Rome by Vitruvius (80-15 BC), who is famous for asserting in his book *De architectura*, also known as *The Ten Books on Architecture*, that

architecture must exhibit the three qualities of *firmitas, utilitas and venustas* — which means that it must be solid, useful and beautiful. (Wikipedia, 2010) Today most architecture students hear about the three elements in their first architecture history classes. Nevertheless the understanding of the words is not universal, but constantly changing throughout time and place.

According to Hillier and Leaman a building has four main functions (Hillier, B. and Leaman, A., 1976 in Voordt and Wegen, 2005): spatial organisation of activities, climate regulation, symbolic function and economic function. The spatial organisation of activities is described as building providing ‘optimum support for the activities desired by properly arranging the available space’ (Voordt and Wegen, 2005).

Moreover, *Utility* or *Usability* is often translated to a widely used term in architecture: *Functionality*. Architectural publications describe a *Functional quality* of a building as ‘its ability to fulfil the functions envisaged for it’ (Voordt and Wegen, 2005). The *functionality* of a building is also described together with all four functions listed by Hillier and Leaman, as the extent to which buildings’ spatial and physical qualities support functions of climate, symbol and economy as well as spatial organisation of activities (Voordt and Wegen, 2005). Nevertheless their summary of the concept of *Functional quality* of a building ‘refers to primarily to a building’s efficiency, practical usability or utility value, taking into account the financial means available.

The concept of *Architectural quality* was described by Voordt and Vrieling (1987) as an integration of: function - *functional quality*, form – *aesthetic quality*, construction - *technical quality* of and costs – *economic quality*.

In a field of facility services there has also been made a distinction between *technical quality* and *functional quality*, where the *technical quality*, as the core of the service process is often more important for the clients, but end-users working on premises see *functional quality* as more important. (Lehtonen, 2006).

During the last 5-10 years there has been a new development of research in *Usability* of buildings and workplaces. The research in usability has been centred around CIB W111 Usability of Workplaces which has produced reports with case studies as well as theoretical and methodological reflections (Alexander, 2005, 2008, 2010). The starting point has been in accordance with ISO 9241-11 to evaluate effectiveness, efficiency and satisfaction of workplaces and the built environment. Blackstad, Olsson, Hansen and Knudsen define *Usability of buildings* as: ‘Buildings true purpose is to support and shelter its users, while they are performing their activities and living their lives. (...) Depending how well they support their users’ activities, our physical surroundings contribute to efficiency, effectiveness and satisfaction in the user organisations’ (Blackstad, et al 2010).

Recently researchers have identified additional key concepts to usability (Alexander, 2008, 2010): Context, culture, situation and user experience that underlie efforts to understand and improve usability in the built environment.

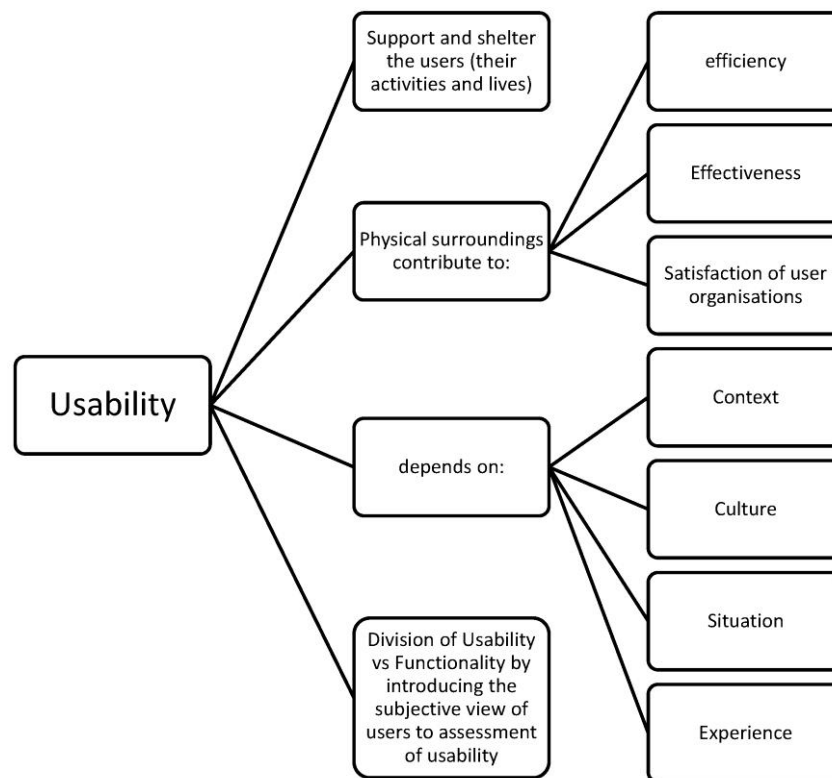


Figure 1 Recent understanding of Usability concept and its main ingredients

Alexander distinguishes between *Functionality* and *Usability*. He explains that it is ‘the use that determines the usability and not the presence of functions. Functions only make certain uses possible’ (Alexander 2006, 2008, 2010). Jensen supports the division of *functionality* and *usability*. He describes the traditional strong focus on *functionality* in the building industry, which is ‘based on technical rationalism, where the attributes of the products are described in objectively measurable terms’. He argues that the introduction of usability concept ‘challenges this approach of technical rationalism by introducing the subjective views of the users’ (Jensen 2010). The interesting result of this is that usability can be evaluated differently by different groups of users. That was the case in *Usability* evaluations of Norwegian university college, where students and staff had different perspectives and the results of usability evaluations of the built environment varied considerably (Hansen and Knudsen, 2006, at Jensen, 2010). Moreover, researchers claim, that evaluating *Functionality* would mean assessing “to which degree the building works according to specifications. *Usability* has a broader scope ... focus on how people utilise the functions to meet

their needs, and their experiences from doing so” (Blackstad et al, 2010). The graphical overview of the recent understanding of *Usability* concept and its main ingredients can be seen on *Figure 1*.

The most known usability assessment methodology is *POE – Post Occupancy Evaluation*. ‘Post occupancy’ refers to the fact that the building is already taken to use at the point of evaluation. The origins of the method are in the USA and it has been used since the 1960s. According to the definition of Preiser et al. (1988, 2005), POE is "the process of evaluating buildings in a systematic and rigorous manner after they have been built and occupied for some time". The British Council for Offices (BCO) suggests two main purposes for a POE. The main aim is to gain feedback of how successful the workplace is in supporting the occupying organisation and individual end-users. The other purpose is to use POE to assess if a project brief – the programme of requirements, has been met. Conventionally, the building occupants would answer questionnaires, participate in interviews and workshops. A few other tools, considered more objective, are also used as part of POE, such as environmental monitoring, space measurement and cost analysis (Wikipedia 2010). Traditionally POE is carried out by trained professionals or researchers with background in social sciences or workplace consulting.

Furthermore, recent international research points out that, “*usability*, with focus on the user perspective, is an often neglected aspect of building performance ... this seems quite odd as most planners, architects and facilities managers will claim that they are strongly concerned about the user perspective and the usability of the workplaces and buildings. The planners and building owners will claim that *functionality* of the workplaces is one of the important success factors for creating a good building. The well-being and satisfaction from the building users are also seen to be very important for some companies and FM-departments” (Hansen et al., 2005). From that perspective additional research in methods to improve usability focus in the design processes is of high value to all parties involved.

Recently the researchers have focused on developing methods for usability evaluations for a broader audience. This has partly taken place in the Erabuild-supported project REBUS (User-orientated Benchmarking for Usability and Sustainable Performance of Real Estates) and one of the results is the so-called USEtool from Norway (Hansen et al., 2009). The author group, Blackstad, Olsson, Hansen and Knudsen made a Usability mapping tool, the USEtool, which is targeted to be used by building owners and Facilities Managers. The research was a development process and a case study for three large Norwegian organisations, who can use the resulting toolbox themselves for assessing usability of their portfolio of buildings. The process has five stages. The first stage is “introductory identification stage (investigation of organisational objectives and relevant user groups), and a systematic general usability mapping and a walkthrough with more in-depth qualitative studies of specific usability topics. The last stages of the process include comparing findings with objectives, and developing recommendations for improvements in existing buildings

or briefing for new facilities” (Blakstad et al, 2010). The REBUS projects have also highlighted the evaluation and briefing, as well as support of the project management processes, as the key processes to achieve usability and effective facilities (Blakstad et al., 2010, Jensen, 2010).

Apart of evaluation of *usability* of existing buildings, there can also be focus on *usability* and *user involvement*. Alexander suggests that to improve usability ‘users must be empowered and communities must be offered the opportunity of meaningful involvement’. He argues that conventional appraisal methodologies are focusing too much ‘on the building as a subject and take functional perspective, rather than ... on the effect of the environment on users and ... processes’. User participation is limited in those processes and the potential for user empowerment is ignored. There is needed a change of perspective, ‘from building and its production, to users and the community’ (Alexander, 2010).

If the *Usability* of the future buildings shall be improved in general, there should also be focus on Usability in preliminary design stages for facilities, for example in *Idea generation* and *Briefing* for new built environments. It is also in those design phases where the user involvement can change much of the programme to improve the future usability and where changes are of low cost for the whole project. The important role of briefing on the final result of built environment was stressed in various publications, for example by Barrett and Stanley (1999) and Blyth and Worthington (2001), Jensen and Petersen (2009) and previously mentioned REBUS project (Blakstad et al, 2010).

CONCEPT OF ‘USER DRIVEN INNOVATION’

According to von Hippel, these days the innovation is being democratized, and it is no longer just the manufactures, but users of products and services—both firms and individual consumers—that are innovating. Von Hippel argues that user-centered innovation processes offer great advantages over the traditional manufacturer-centric innovation development, where the users rely on their imperfect agents. In addition to this, the individual users do not have to develop everything they need on their own, but can benefit from innovations developed and freely shared by others (von Hippel, 2005).

When discussing innovation, it is important to mention the concept of *lead users*. They are those users, who are ahead of the majority of users in their populations with respect to an important market trend, and they expect to gain relatively high benefits from a solution to their needs. Studies have shown that most innovating users have those characteristics, no matter if they are individuals or companies (von Hippel, 2005).

As mentioned in the previous chapter, traditionally manufactures develop and innovate by themselves and use patents and copyrights to protect their business. In this manufacturer-centric model of innovation, the users’ role is only to have needs and it is the producer’s role to try to

identify them and satisfy them by new products. In addition to that, manufactures sometimes invite the lead users for usability testing, where the advanced users can find additional improvements for developing the next prototypes. Generally speaking, it is the “users, who have a more accurate and more detailed model of their needs than manufacturers have, while manufacturers have a better model of the solution approach in which they specialize” (von Hippel, 2005).

Users needs were important to computer software development since the 1960's. A research group at Stockholm business school developed ISAC - a method that starts by considering the needs, problems, and ideas of the users, proceeding immediately to the specification of manual activities and computer programs (Floyd et al., 1989).

Already in 1989 Floyd et al. (1989) noticed a new trend of *User involvement* in software design and described it in the article *Out of Scandinavia: Alternative approaches to Software Design and Systems*. There were a couple of main characteristics of the new Scandinavian approach. The most important was the cooperation between developers and users, considered a crucial factor and getting methodological support. Furthermore various forms of prototyping were used to provide technical support for the process of mutual learning. The users were getting help to progressively qualify themselves for the process. The main goal was to adapt software to meet the needs of specific user communities. In addition to this the traditional participation approaches were extended by adoption of the two principles - mutual learning and designing by doing. The *mutual learning*, also called *co-learning* means, that both users and developers are reliant on mutual process of learning and communicating. The *designing by doing* means that there was experimentation and testing already in early stages, such as using prototyping and promoting communication and learning processes. Last, but not least a new concept arrived, that revolutionised the *User involvement* methods – the concept of *Co-creation*. The groundbreaking change was that now innovation and design was not done ‘with’ nor ‘for’ users, but ‘by’ users! (Ehn & Kyng, 1987)

In the recent years, we have seen in some fields that it is truly the users, who are first to develop most of new consumer products, as the computer software and communication possibilities are steadily growing, resulting in *user-centric* or *user driven innovation*. The surprising empirical finding is that users often freely reveal their innovations. The practices visible in “open source” software development were important in bringing this phenomenon to general awareness (von Hippel, 2005).

The recent shift to *User driven innovation* has very attractive qualities. Von Hippel describes two of them. First of all users easily get precisely what they want by designing it for themselves. Secondly the innovation by users appears to increase social welfare. Nevertheless there are some challenges to obtain a widespread *User driven innovation*. The manufactures must be able to apply the needed fundamental changes. Moreover, the governmental policy and legislation should stop supporting the manufacturers-innovation only (von Hippel, 2005). Furthermore, von Hippel summarises the

various qualities of User driven innovation in his book *Democratizing Innovation*, like this : “Users’ ability to innovate is improving *radically* and *rapidly* as a result of the steadily improving quality of computer software and hardware, improved access to easy-to-use tools and components for innovation, and access to a steadily richer innovation commons.” In addition to that, he predicts, that innovation by users will continue to grow, even if both users and manufactures have a constant willingness to invest in obtaining a precisely right product (von Hippel, 2005).

Generally *User driven innovation* methods can be divided into three groups:

- 1) lead user approach – first mentioned by von Hippel, where the lead users are gathered with the project team at workshops where fast prototypes are made, then R&D department develops further
- 2) ethnographical approach – the aim is to find the needs, both known and tacit, by studying the users in their everyday situations, the used tools can be: observations, workshops, interviews
- 3) Participatory design /innovation - the users are co-designers, methods can vary and are chosen to fit the exact project (Danish Enterprise and Construction Authority, 2010)

DISCUSSION / CONCLUSION

As described in previous paragraphs, the concepts of *Usability* and *User driven innovation* have several common features and benefits. The most recent understandings of the two concepts are summarised below.

Usability of the built environment is a quality of a building consisting of four elements: 1) Support and shelter the users, while they are performing their activities and living their lives, 2) Contribution to efficiency, effectiveness and satisfaction in the user organisations, 3) Dependence on context, culture, situation, experience, 4) Assessed by subjective view of users (unlike the functional quality that aims for objective data)

User driven innovation in the built environment is one of the methods of user involvement that can be used in planning new facilities or improving existing ones. Its main characteristics are that 1) users have most accurate model of their needs, 2) users are actively involved already at early stages, 2) there is co-learning and co-creation between the users and the designers (the participatory innovation), 3) democratised design process improves social welfare.

The question in this paper was *to what extent*, and *how* users can be involved in design processes to create better and innovative buildings of enhanced usability and if the concepts of *Usability* and *User driven innovation* are in unity or clash.

From one point of view, some fields would consider the *Usability* and *User driven innovation* as two clashing concepts, or that one – *Usability (tests)* is an older method that has been made

redundant by a newer method - *User driven innovation*. For example in product development there has been a shift away from the type of user involvement in the middle or end of the development process, where the users could give feedback on the usability of the product prototype and the result would most often be a development of a new prototype by the professionals. The new and more used method is *User driven innovation*, where the product is co-created by the users and designers together, and the process runs already at early stages of product development. Therefore *User driven innovation* leads to the situation, where there is no need to develop several finished prototypes, which must be tested and improved in several *Usability Tests*, because the developed product is co-created to fulfil the needs from the start. Those two understandings are indeed clashing.

On the other hand, there is an important fact, that the built environment is, unlike products, not developed as a prototype, which can be mass produced afterwards. Instead of that, each building is custom made, a prototype which is never repeated. Nevertheless, there is one exception - the standardised type family houses. Therefore in general, it means that the *Usability* of buildings cannot be understood as *usability tests* leading to more prototypes, but as a quality of a building.

Furthermore, it is easy to see the similarities in the two concepts. First of all, both concepts rely on the users and involve them. *Usability* can only be assessed with users, who can subjectively describe how well the facilities support their activities, and what are their experiences. *User driven innovation* can only occur with the active role of users in co-designing and innovating. The conclusion could be that *User driven innovation* is one of the user involvement methods to achieve a better *Usability* of facilities.

Additionally, there are a number of user involvement methods and they all might be used for planning new buildings. If the aim for the involvement is better usability, most of them can be used, but achieving better usability might depend on how strong is the usability focus of the design team and type of user involvement. *Usability* evaluations like POE – Post Occupancy Evaluations can be one of the tools. In the traditional understanding those tools would be used to evaluate existing buildings in use and possible make small improvements. *User driven innovation*, as a method of user involvement, which can be used from the beginning of the process of planning a new facility. In this method the focus is on satisfying the users' needs, innovation and co-learning and co-designing with the professional design team. The chances of *Usability* focus in the process of *User driven innovation* are even higher than in other user involvement methods.

However, *Usability* evaluations of buildings, like POE can potentially also be used in planning and briefing for new facilities. That thought comes from the common belief that users can and perhaps should be involved in much earlier stages of project development and in a much broader extent than traditionally in the building sector. One of the possible ways to achieve that is to make *Usability evaluations* at early design stages, in cooperation of the design team and users of buildings in use,

which are similar to the planned one. In that way co-learning can occur and there can be achieved a deeper understanding of users needs and potential possibilities. The claim is that would result in a better usability of the built environment.

Finally, even though the two concepts may seem to clash in some professional fields, we can see that understanding them as unity is potentially of great value to the built environment, which would result in being more usable and innovative. *User driven innovation* is one of the user involvement methods that easily approaches the task of planning a facility with a focus on *usability* and users' satisfaction and therefore is closest to *Usability*. Furthermore, *Usability evaluations*, when used in briefing and planning new facilities together with users, can further strengthen the cooperation and co-creation of the design team and users as well as potentially the focus on *Usability* of the entire design process. This unity of the concepts might be the ultimate step towards better usability of the built environment in the future.

The implications for the future research are the requirement of further future studies in using the methods in a broader audience, testing the results and showing the evidence to research community and practice. It is recommended to further test and evaluate the use of the concepts of *Usability* and *User driven innovation* in the practice of planning and evaluating of the built environment. This could be carried out in different contexts and potentially confirm the positive effects of user involvement and usability focus in planning of the buildings, which would make the results even more visible across the professional fields. Another question to be studied and answered is: who shall be responsible of those processes? There are several possible choices: the client and Facilities Manager, the architect, the competition programming advisor. Each might have their agendas. Further research in those topics is highly recommended.

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